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A Cahners Publication

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CE is an up-and-coming separations technique that offers you more potential applications than either HPLC or HPGC.



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Multidimensional gas chromatography can give you full separations of complex organic mixtures.

ABOUT THE COVER Capillary electrophoresis separates complex molecules quickly. The metoclopramide image was optimized on the CAChe Worksystem by Steve Wright, Tektronix. The electropherogram courtesy of Herbert Schwartz, Beckman Instruments. For more on CE, turn to page 28.

R&D BUSINESS

New ICs Push U.S. and Japanese Growth In Electrical Measuring Instruments

Japanese and U.S. analysts are forecasting 7% or more annual growth in the sales of electrical testing instruments through 1994, following increased demand for testing equipment related to 4-, 16-, and 64-Mbit DRAM chips in both countries.

Increased satellite broadcasting and mobile communications, and new communication networks such as ISDN, are helping drive the increased growth forecasts by the U.S. Dept. of Commerce, Washington, DC, and the Japan Electric Measuring Instruments Manufacturers' Assn., Tokyo.

Electrical test instruments mentioned include signal generators, communication test equipment, oscilloscopes, spectrum analyzers, automatic test equipment, and panel instruments.

U.S. shipments dropped in 1990 from 1989 levels, a result of soft defense demand and relatively few new semiconductor devices from domestic manufacturers. Japanese shipments increased in 1990 reflecting an earlier

transition by Japanese manufacturers from 1-Mbit DRAM production to higher density products.

U.S. instrument exports exceed imports by more than four to one, but part of this apparent trade imbalance is negated by the growth of Japanese investment in U.S. manufacturers. Nine U.S. electrical test equipment facilities are owned by Japanese firms. These account for almost 10% of the total U.S. production employment in this industry.

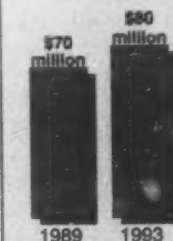
—Tim Studt

Co-Venturing Creates New Foreign Markets

Product-oriented U.S. firms have the opportunity to design and build production facilities for foreign entrepreneurs, according to Jack Baranson, a senior associate at the Illinois Institute of Technology Research Institute, Chicago.

"The Chinese government, for example, has recently set up a joint ven-

Slow Growth for X-ray Diffraction Systems



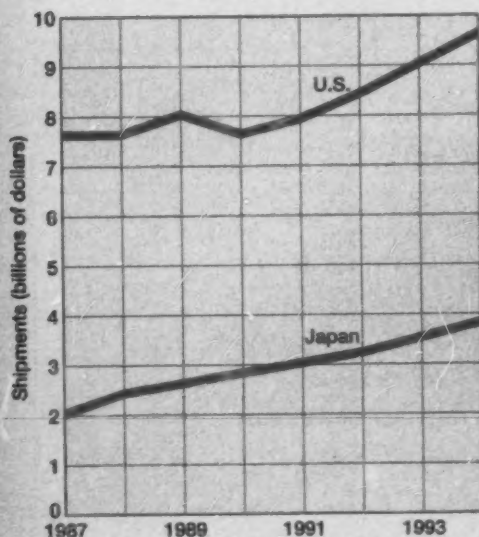
The market for x-ray diffractometers is forecast to grow 3.4% annually over the next four years to \$80 million in 1993, according to Strategic Directions Intl., a Los Angeles-based market research firm.

The leading purchasers of these instruments are universities and government, with the main users being chemical and petroleum firms.

ture with a U.S. firm to design and build a series of plants for Chinese enterprise groups in China," says Baranson. "Co-venturing is likely to be the predominant option in newly industrialized countries."

Some product manufacturers have already begun restructuring to include process development. For instance, UOP Inc., Des Plaines, IL, now has three distinct profit centers—a product manufacturing group, a design engineering group that develops new products and processes, and a construction engineering group that designs and builds industrial plants. □

U.S. and Japan See Strong Growth In Electric Test Equipment



Source: U.S. Dept. of Commerce, Japan Electric Measuring Instrument Manufacturers Assn.

1990 U.S. Trade Balance



Shipments of electric measuring instruments are forecast to increase 7% annually from 1991 through 1994 for U.S. suppliers and 7.9% for Japanese firms.

Federal R&D Grows, But All Is Not Rosy

U.S. research capabilities have grown substantially over the past 30 years, but the Federal research system must seek improvements in the 1990s, according to a recent report issued by the U.S. Office of Technology Assessment.

The report, *Federally Funded Research: Decisions for a Decade*, states that Federal research policy makers must establish new methods of setting priorities; devise ways to cope with and understand research expenditures; develop human resources for research throughout the educational system from elementary through graduate school; and obtain comparable data from all agencies to main-

Salaries Up, Benefits Down, U.S. Researchers Say

Nearly nine of every 10 employees surveyed got raises last year, but many also saw cutbacks in their total compensation packages.

By John Morkes, Associate Editor, R&D Magazine



Winners in 1990 included mathematicians, 8.3% of whom got raises of at least 14%, and aeronautical engineers, who had the highest median salary, \$58,333. Not faring so well were geologists, 21% of whom received no raise at all.

There is good news and bad news to report about the compensation packages U.S. researchers received last year.

The good news is that despite rising health insurance costs and a looming recession, 88.8% of the employees earned salary increases.

The bad news is that many of the raises were small, and take-home pay often was eroded by higher employee contributions for benefits.

That is the general assessment of more than 4,800 respondents to R&D Magazine's annual salary survey.

For the 12 disciplines surveyed, 37.6% of the employees received raises of 6% or more (see chart).

Chemical engineers, with 41.1%, had the highest percentage of raises of at least 6%, and geologists, with 25.6%, had the lowest.

For each discipline, the most common raise amount was between 2% and 5%.

Aeronautical engineers had the highest median salary in 1990, \$58,333, followed by physicists, with \$58,062. Industrial engineers ranked last, with \$46,636, a drop of 6.1% from last year's survey.

In 1990, 43.9% of the respondents received raises that beat inflation, down from 46.5% the previous year.

Many of those surveyed complained that their raises were too low.

R&D Salary Survey: How Do You Measure Up?

All Disciplines Compared	1990 Salary Raise Amount						1991 Salary Range			Years With Present Employer		
	None (%)	Less than 2% (%)	2 thru 5% (%)	6 thru 9% (%)	10 thru 13% (%)	14% or more (%)	Median	\$20,000 (%)	>\$100,000 (%)	Median	<1 (%)	>36 (%)
Aeronautical Engineer	7.5	—	62.5	21.3	6.3	2.5	\$58,333	—	—	12.4	—	2.5
Biology/Biotechnology	11.3	1.4	48.4	26.5	7.2	4.6	49,838	2.0	2.6	8.6	5.5	1.4
Chemical Engineer	12.0	0.6	45.8	29.5	8.4	3.2	54,750	—	4.5	8.9	6.5	2.3
Chemist	8.7	0.7	49.8	29.1	7.6	3.4	51,794	0.8	1.8	10.6	3.2	1.7
Electrical Engineer	11.5	1.6	53.2	23.5	7.1	2.5	54,030	1.4	2.1	9.5	2.1	2.1
Geologist	21.0	4.6	48.9	20.9	4.7	—	55,500	—	—	11.2	6.7	—
Industrial Engineer	15.9	1.6	52.4	20.6	5.1	4.5	43,636	—	—	6.5	6.3	—
Materials	11.6	7.8	49.9	29.1	5.7	1.8	54,107	1.3	2.3	8.1	4.4	1.3
Mathematician	16.7	4.4	41.7	25.0	4.0	8.3	56,666	—	4.2	13.0	4.3	4.1
Mechanical Engineer	13.2	0.7	48.5	27.0	8.3	2.4	49,578	0.3	2.0	7.9	5.2	1.5
Nuclear Engineer	11.9	—	59.5	26.2	2.4	—	55,010	—	4.8	11.9	2.6	2.2
Physicist	14.1	0.9	47.4	25.8	7.5	3.3	58,062	0.6	4.5	8.6	4.2	0.9

Discipline Rankings by Median Salaries

Rank		Discipline	Median Salary		Percent change
1991	1990		1991	1990	
1	1	Aeronautical Engineer	\$58,333	\$56,111	3.7
2	2	Physicist	58,062	54,500	6.5
3	8	Mathematician	56,666	49,998	13.3
4	6	Geologist	55,500	51,250	8.3
5	*	Nuclear Engineer	55,010		
6	4	Chemical Engineer	54,750	52,931	3.4
7	*	Materials	54,107		
8	7	Electrical Engineer	54,030	50,978	5.9
9	10	Chemist	51,794	48,312	7.2
10	12	Biology/Biotech	49,838	46,315	7.6
11	9	Mechanical Engineer	49,578	49,280	0.6
12	11	Industrial Engineer	43,636	46,448	-6.1

*New categories this year

The salary race: Aeronautical engineers and physicists again led the pack, as industrial and mechanical engineers fell back. Mathematicians enjoyed the biggest gain.

"Merit review rates me highly, but raises never match the inflation rate," said an industrial materials researcher.

"I get 4% of \$50,000 for a raise, and the CEO gets 21% of \$5 million!" exclaimed a chemical engineer.

University researchers complained that they would make more money working in industry.

"Academic salaries stink," a chemist said. "I'd probably double my sal-

ary if I were in an industrial lab."

A small salary or raise would be frustrating enough, without the burden of higher employee contributions for what respondents said were declining health benefits.

"The employee's share of costs increases each year to wipe out any salary increases," said a government biologist.

"We continue to pay more and

more money for less and less coverage on our medical insurance," said an industrial physicist. "It's like a double increase, to pay more for less coverage every year."

Employers are switching to less expensive insurance policies, largely because hospitalization policy costs jumped 30% in the span of a year, said Sanford Rose, president of Sanford Rose Associates International, Akron, OH, a recruitment firm for high-tech fields.

As a result, more health insurance costs were passed on to employees, which angered many respondents.

"The company has cut the medical plan to cut its costs," said a chemist. "It has resulted in less coverage and more paperwork. We need a national health insurance plan available to all, financed by employer taxes. Health costs and availability are a disgrace."

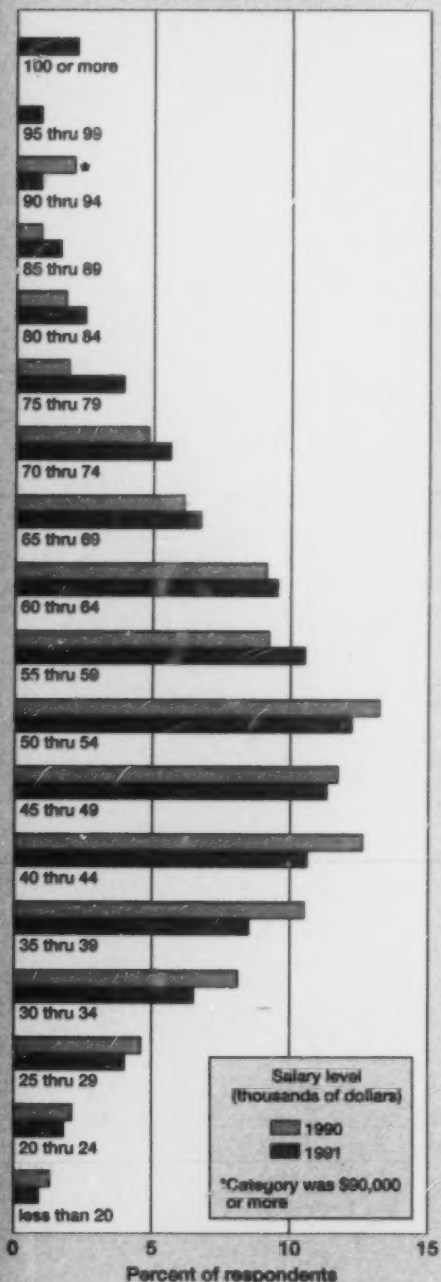
The subject of financial benefits also generated angry comments. Across all disciplines, less than half of all respondents were offered profit sharing, merit bonuses, or patent awards/royalties by their employers (see "Financial Benefits" chart). Nevertheless, a majority of employees in 10 disciplines were offered 401(k) savings plans.

Employees said they want more fi-

Age, Years			Experience, Years			Highest Academic Degree				Financial Benefits			
Median	<26 (%)	>65 (%)	Median	<1 (%)	>40 (%)	<BS (%)	BS (%)	MS (%)	PhD (%)	Profit-Sharing	401(k) Plan	Merit Bonuses	Patent Awards/Royalties
45.1	3.8	5.1	21.5	—	6.3	6.3	31.4	41.3	21.2	23.8	60.0	28.8	49.0
43.9	1.7	3.4	16.1	—	1.7	2.0	19.5	24.7	53.7	17.2	42.4	29.9	20.9
40.1	2.9	1.9	13.5	1.0	1.6	3.2	39.5	29.4	27.8	29.9	68.1	33.9	31.6
43.8	1.9	2.3	17.4	0.6	1.7	3.6	33.8	20.3	42.3	28.7	64.5	30.4	23.5
44.3	2.3	1.4	16.9	0.5	1.1	16.8	35.6	30.8	16.8	28.1	66.8	29.9	33.9
45.4	—	4.4	21.2	—	6.8	4.4	15.6	33.3	46.7	22.2	48.9	37.8	15.6
38.7	1.6	—	9.3	3.1	—	21.9	39.1	28.1	10.9	36.5	52.4	31.7	28.6
41.9	2.9	2.1	15.6	0.3	1.8	7.5	26.4	28.1	40.0	20.6	64.8	28.9	46.4
43.7	4.2	—	13.3	—	—	—	41.7	37.5	20.8	29.2	54.2	41.7	25.0
43.4	2.5	2.3	13.8	1.6	1.4	16.9	39.9	29.3	13.7	27.3	63.0	27.2	33.8
45.9	—	2.3	18.2	2.5	—	7.1	23.8	28.6	40.5	17.9	71.8	35.7	36.1
45.4	3.0	1.5	18.2	—	0.9	2.1	18.7	26.2	53.0	21.9	53.5	31.0	42.2

'I am tired of being in the front lines of the battle to balance the Federal budget,' says a government physicist.

Salary Levels For All R&D Workers (1990 and 1991)



Salaries for R&D workers in 1991 are generally about the same or slightly higher than salaries in 1990, according to more than 4,800 survey respondents.

nancial benefits and want them linked more closely to their accomplishments.

"There's no real incentive for good work. Don't work for the government!" exclaimed an agricultural engineer.

"We used to be able to get a bonus based on performance," said an industrial chemist. "Now, it's based solely on level, and you have to be two levels higher than I am to get it—then it's automatic! Why work hard, just so the next guy can get a fat bonus check?"

Overall, respondents said they were generally dissatisfied with their benefits packages, which they see as diminishing.

"My compensation package is lousy and rapidly getting worse," said one electrical engineer.

"The trend has been toward decreasing benefits," said a physicist at a leading computer manufacturer. "World-class companies should have benefits that are 'world class.' Ours are more like 'Third-World class.'"

"We had the best profit-sharing plan when we had no profits," said a chemist. "The plan was drastically revised when we began to see meaningful profits."

Many government employees who complained about low compensation also expressed concern about possible furloughs. The surveys were mailed at the time of the government budget crunch last October.

"With the limited prospects for the future, including the likelihood of government furlough in the immediate future, it is hard to keep my spirits up and my wife happy," said a chemist.

"I am tired of being in the front lines of the battle to balance the Federal budget," said a government physicist.

Respondents identified a trend in employee compensation toward "cafeteria-style" benefits packages that let employees choose their own benefits, up to a set dollar amount.

One industrial physicist said he likes the "freedom to choose from a 'cafeteria list' of benefits."

The average employee may actually lose benefits as a result of the cafeteria-style plan, according to recruiter Rose, because it is often a cost-cutting measure taken by the employer. However, the survey shows that some em-

Increases in Rate of Pay for All R&D Workers*

Percent of respondents

Amount of Increase	1991	1990	1989
None	11.2	9.2	9.3
Less than 2%	0.9	2.1	5.3
2 thru 5%	50.3	54.9	54.8
6 thru 9%	27.2	24.7	22.2
10 thru 13%	7.2	5.9	5.6
14% or more	3.2	3.2	2.7
Ahead of inflation	43.9	46.5	44.2

*Granted in preceding year for year shown

Despite the looming recession, many of the percentage increases in 1990 were higher than in previous years.

ployees prefer it. Those without dependents are interested, for example, because the plan offers them benefits they want instead of insurance coverage they do not need.

Not all respondents had only negative comments, however. Some said they like at least part, if not all, of their compensation packages.

"Working in a university cost me about \$25,000 a year, but it was worth it to do my own research," said a chemist.

"Merit bonuses in our division have resulted in increased productivity," a materials researcher said.

"There is an on-site fitness center, which is excellent," said an industrial chemist.

"The 401(k) savings plan helps avoid taxes and save for retirement," said another industrial chemist.

For the most part, though, respondents had few positive things to say. When asked "What do you like best about your compensation package?" one mechanical engineer simply wrote, "Nuttin."

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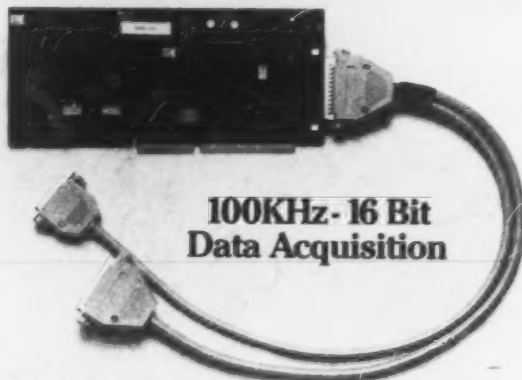
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